

## Tinospora Cordifolia: A Green Treasure

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### **ABSTRACT**

Since the beginning of human civilization, plants have been one of the important sources of medicines. The demand for herbal medicines, health products, cosmetics etc continues to grow. Giloy is commonly known as "Guduchi" and is known for its immense use in traditional Ayurvedic literature for the treatment of various ailments. It is a popular herbal medicine found in tropical regions, used in the diet of various tribal peoples of India and part of traditional Indian cuisines. The compounds were isolated from Giloy, making the new formulation effective in eradicating the disease. Recently, the discovery of the active constituents of this plant and its biological functions in disease control has generated a great worldwide interest in this plant. This article summarizes the chemical constituents and pharmacological effects of the different parts of *Tinospora cordifolia*.

**KEYWORDS:** Ayurveda, Phytochemicals, Giloy, Pharmacological actions, Anticancer

**How to cite this paper:** Ragini D. Patil | Swati S. Barve | Dhananjay S. Pachorkar | Jyoti R. Palde | Urmila D. Nikam "Tinospora Cordifolia: A Green Treasure" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-7 | Issue-2, April 2023, pp.934-939, URL: www.ijtsrd.com/papers/ijtsrd56201.pdf



IJTSRD56201

URL:



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### **INTRODUCTION**

Giloy is a deciduous climbing shrub that belongs to the moonseed family. The botanical family consists of approximately 70 genera and 450 species of plants distributed throughout the tropics. It is found throughout India and parts of Sri Lanka, Bangladesh and China. The plant is referred to in Ayurveda as Rasayana and is known to strengthen the immune system and the body's defense against certain infectious microorganisms.<sup>[1]</sup> Giloy is a climbing shrub with a genetic diversity of and typical yellow-green flowers that grow at high altitudes. In Ayurveda it is referred to as "Rasayana" therapy, recommended to boost the general resistance of the body, to promote longevity and as a stress reliever and performance enhancer. Giloy leaves are rich in protein, calcium and phosphorus.<sup>[2]</sup> Different chemical constituents such as giloins, columbine, chasmantine, palmatine,

isocolumbine, tembetarine, spray, ecdysterone, cordioside, tinocordifoliin, tinocordifolioside and tinosporic acid are found in different parts of giloy such as stems, leaves etc.



**Figure 1 Giloy Plant**

### **Taxonomic Position of Giloy:**

**Table 1 Taxonomic Position of Giloy**

Kingdom	Plantae
Subkingdom	Tracheophyta (Vascular Plants)
Super-division	Spermatophyta (Seed bearing plants)
Division	Magnoliophyta (Flowering)

Class	Magnoliopsida (Dicotyledons)
Subclass	Polypetalae (Petals are free)
Series	Thalamiflorae (Many stamens and flower hypogynous)
Order	Ranales

**Table 2 Common Names Of Giloy**

Latin	Tinospora cordifolia
English	Gulancha/ Indian Tinospora
Sanskrit	Giloy, Madhuparni, Amrita, Chinnaruha, Vatsadaani, Tantrika, Kundalini
Hindi	Giloya, Giloy
Bengali	Gulancha
Telugu	Thippateega
Tamil	Shindilakodi
Marathi	Shindilakodi
Gujarathi	Galo
Kannada	Amrita balli

**Distribution and Morphology:**

Giloy plants are distributed in tropical areas like Andaman nicobar, Maharashtra, Kerala and subtropical regions like Punjab, Uttarakhand in India. It is native to India, Sri Lanka, China, Myanmar, Thailand, Philippines, Indonesia, Malaysia, Vietnam, Bangladesh and South Africa. It is a large, deciduous, spreading climbing shrub with several slender, twining branches. It typically grows in deciduous and dry forests at elevations up to 1000 feet. It is a climbing shrub native to lower elevations in the tropics of the Indian subcontinent and climbs a variety of trees. It likes a wide range of acid soils rather than alkaline soils, and it needs moderate soil moisture.<sup>[3]</sup>

**The Morphology of Giloy plant is as Follows :****A. Leaves:**

Leaves are dark green in large patches, but mature leaves are chartreuse to yellow. The leaves are bitter and give off a slight odour. The leaves are oval and heart-shaped, with pieces, 10-20 cm long and 8-15 cm wide<sup>[4]</sup>. The leaves are rich in protein, calcium and phosphorus.

**Figure 2 Leaves of giloy plant.****B. Flowers:**

The flowers are small, unisexual, yellow-green. There are male flowers and solitary female flowers. The

sepals are six in number in two sets of three. The outer sepals are smaller than the inner sepals. The petals are also six in number, smaller than the sepals, free and membranous. The flowers are visible in summer (March to June)<sup>[5]</sup>.

**Figure 3 Flower of giloy plant****C. Fruit:**

The fruit is fleshy, single-seeded, and is an aggregate of one to three. It is a small drupe on a thick stem with a proximal scar. The fruit is ovoid, smooth, scarlet or orange-red. These appear in winter<sup>[6]</sup>.

**Figure 4 Fruit of giloy plant**

#### D. Roots

The roots are aerial, filiform, filamentous, filiform, square, arising from mature shoots or truncated stem pieces, growing downwards, sometimes reaching the ground by continuous extension<sup>[7]</sup>. Microscopic observation of aerial roots characterized by a primary arch structure of tetrapenta. However, the root cortex is divided into an outer sclerenchyma zone and an inner parenchyma zone. The dried aerial roots are light gray-brown or milky white, odorless and bitter tasting.



**Figure 5 Roots of giloy plant**

#### E. Stem:

The stems of this plant are very succulent, long, silky, fleshy and climbing<sup>[8]</sup>. The outer bark is thin and

papery, brown to gray in color. Stem powder is milky brown to dark brown, with a peculiar odor and bitter taste. The starch extracted from the stem known as "Giloy-satva" is very nutritious and digestible and is used in the treatment of many diseases. The stems of this plant are very succulent, long, silky, fleshy and climbing.



**Figure 6 Stem of giloy plant**

#### Active Constituents Of Giloy:

Several ingredients have been isolated and elucidated from the Giloy plant. These constituents belong to different classes such as diterpene lactones, alkaloids, steroids, glycosides, polysaccharides, aliphatics, phenols, sesquiterpenoids<sup>[9]</sup>.

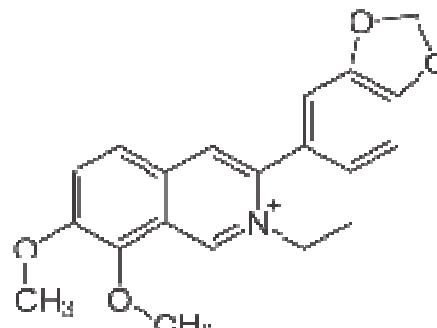
**Table 3: Active Constituents in Giloy Plant**

Sr. no.	Metabolites	Active Chemical Constituents	Part of Giloy	Pharmacological action
1	Alkaloids	Berberine, Palmatine, Tembeterine, Magnoflorine, Tinosporin, Isocolumbin	Stem Root	<ul style="list-style-type: none"> <li>➤ Antiviral infections</li> <li>➤ Neurological Disorder</li> <li>➤ Anti-diabetic</li> </ul>
2	Glycosides	Tinocordiside, Cordioside	Stem	<ul style="list-style-type: none"> <li>➤ Antiparkinson</li> </ul>
3	Diterpenoid	Furanolactone	Whole plant	<ul style="list-style-type: none"> <li>➤ Vasorelaxants,</li> <li>➤ Antiinflammatory,</li> <li>➤ Antimicrobial</li> <li>➤ Antihypertensive</li> </ul>
4	Steroids	Beta-sitosterol	Stem aerial parts	<ul style="list-style-type: none"> <li>➤ Treat Rheumatoid arthritis</li> </ul>
5	Aliphatic compounds	Octacosanol	Whole plant	<ul style="list-style-type: none"> <li>➤ Anti-nociceptive</li> <li>➤ Anti-inflammatory</li> </ul>
6	Others	Giloins, Tinosporic acid	Root	<ul style="list-style-type: none"> <li>➤ Used to treat anxiety,</li> <li>➤ Protease inhibitors for HIV</li> </ul>

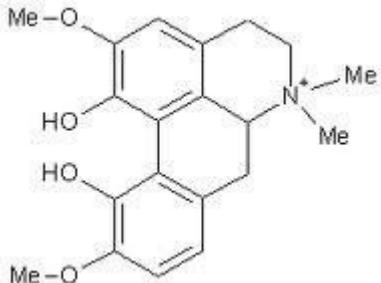
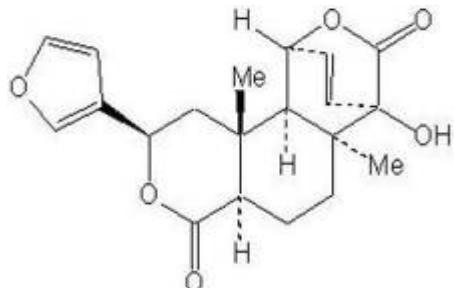
#### 1. Alkaloids:

Alkaloids have a wide range of pharmacological activities, including antiviral, nervous, antidiabetic, etc<sup>[10]</sup>. Some synthetic compounds with similar structures may also be referred to as alkaloids. This group also includes some related compounds with a neutral or even weak acidity of.

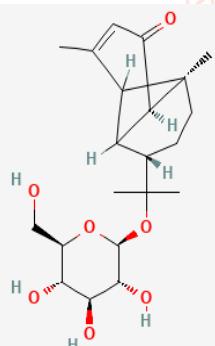
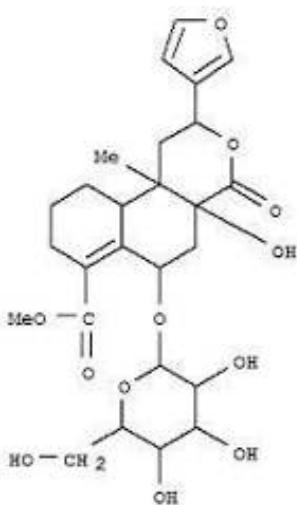
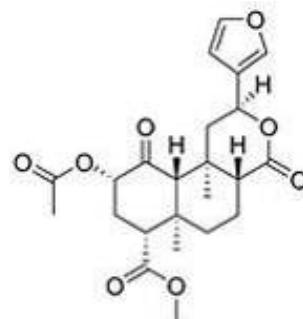
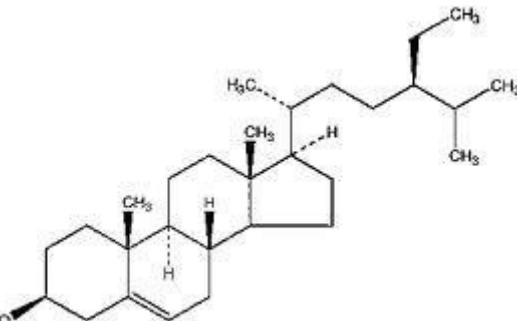
only lower blood sugar but also LDL (bad) cholesterol and blood pressure.



**Figure 7 Structure of Berberine**

**B. Magnoflorine:****Figure 8 Structure of Magnoflorine****C. Isocolumbin:****Figure 9 Structure of Isocolumbin****2. Glycosides:**

Glycosides play many important roles in living organisms. Many plants store chemicals as inactive glycosides. It can be activated by enzymatic hydrolysis, causing the sugar to partially break down, making the chemical usable. Many of these phytoglycosides are used as drugs<sup>[11]</sup>.

**A. Tinocordioside:****Figure 10 Structure of Tinocordioside****B. Cordioside:****Figure 11 Structure of Cordioside****3. Diterpenoid:****A. Furanolactone:****Figure 12 Structure of Furanolactone****B. Beta-sitosterol:****Figure 13 Structure of Beta-sitosterol****Pharmacological Aspects:**

Giloy has been considered the most widely used herb in traditional medical systems for centuries for its antispasmodic, non-allergenic and anti-diabetic properties. The plant significantly improves the immune system. This plant has many useful properties. Its root is known for its anti-stress and antimalarial properties, while its stem is used as a stomach bitter and diuretic. It stimulates the secretion of bile, nourishes the blood and treats jaundice.<sup>[12]</sup> Some of the biological activities of giloy are:

**1. Anti-Diabetic Activity:**

The stems of this plant are commonly used to treat diabetes by regulating blood sugar. It has been reported to act as an anti-diabetic agent by eliminating oxidative stress, which promotes insulin secretion by inhibiting gluconeogenesis and glycogenolysis. The antidiabetic properties of this plant are attributed to the presence of alkaloids (Magnoflorine, Palmetine, Jatrorrhizine), tannins, cardiac glycosides, flavonoids, saponins, steroids, etc.<sup>[13]</sup> Ethyl acetate, Crude stem extracts in dichloromethane, chloroform and hexane inhibit enzymes such as saliva, amylase and glucosidase, which lead to increased postprandial blood glucose and exhibit antidiabetic activity potential. Root extracts of this herb also have antidiabetic properties, reducing levels of glycated hemoglobin, hydroperoxidase, and vitamin E.

**2. Anticancer Activity:**

Giloy is an antioxidant, which means it can help protect cells against oxidative damage. It inhibits oral

cancer cells in a dose-dependent manner by inducing apoptosis and attenuating the epithelial-mesenchymal transition. This plant is well characterized for its radio protective properties, as it significantly increases the weight of various tissues as well as body weight.<sup>[14]</sup> Among other things, it provides protection against gamma radiation (sublethal range).

### **3. Antitoxin Activity:**

Giloy has the potential to scavenge free radicals and has been shown to protect by altering levels of various hormones and minerals. Due to the presence of antioxidants, aqueous extracts of this plant have been reported to exhibit scavenging activity against free radicals generated during aflatoxin poisoning. Other alkaloids such as Giloy's choline, tinosporine, isocolumbine, palmetine, have shown protective effects against aflatoxin-induced nephrotoxicity. Additionally, Giloy reduced the concentration of thiobarbituric acid reactive substances (TBARS) and increased glutathione (GSH), ascorbic acid, protein, superoxide dismutase (SOD), catalase (CAT) and other anti-oxidase activities to show a protective effect, glutathione peroxidase, glutathione increased.<sup>[15]</sup>

### **4. Neuroprotective Activity:**

Giloy has beneficial properties for patients suffering from depression, old age and Alzheimer's disease, and memory impairment.<sup>[16]</sup> Giloy has significant neuroprotective activity, modulating antioxidant enzyme systems in brain tissue and protecting dopaminergic neurons. Giloy also improves cognition (learning and memory) by increasing the synthesis of the neurotransmitter acetylcholine.

### **5. Anti-inflammatory and Antipyretic Agent:**

Traditionally, giloy preparations have been used to treat fever, inflammation, and pain. These preparations reduce carragenan-induced enema, suggesting their anti-inflammatory potential.<sup>[17]</sup> Also detected the anti-inflammatory effect of giloy in autoimmune arthritis mediated by a decrease in the synthesis of pro-inflammatory cytokines. There is also some evidence to suggest that giloy may mediate peripheral and central nervous system mechanisms and exert analgesic effects.

### **6. Anti-Depresant Activity:**

Depression is characterized by reduced levels of monoamines in the brain, such as noradrenaline, serotonin and dopamine. Established antidepressants work by inhibiting the reuptake or degradation of these amines and increasing their levels at post-synaptic receptors. Inhibition of monoamine metabolism, particularly serotonin and norepinephrine, has also been demonstrated.<sup>[18]</sup>

### **7. Anti-Stress Activity:**

It is claimed to help maintain healthy brain function and also helps with stress management. Traditionally, giloy root is used for its anti-stress activity. Its anti-stress activation system has been demonstrated by its effects on brain neurotransmitters. Supporting evidence relates to the normalization of stress-induced biochemical changes in root extracts of norepinephrine, dopamine and serotonin giloy is one of the components of a multi-herb preparation.<sup>[19]</sup>

### **Other Properties<sup>[20]</sup>:**

1. The stem of giloy have a bitter taste, stomachic, diuretics, stimulate the secretion of bile, analyse thirst, nourish the blood and cure jaundice.
2. Plant stem juice can be used for diabetes, indigestion, leucorrhoea and urinary tract discharge.
3. The bark of this plant has antiallergic, antispasmodic, antipyretic, antileprosy properties.
4. Powdered roots and stems are used with milk to treat cancer.
5. The whole plant is used for pig scabies, diarrhea, urinary diseases, syphilis, skin diseases, bronchitis, can prolong life, increase body resistance and stimulate the immune system.
6. Dried fruit powder mixed with ghee or honey is used as a tonic, is also used in the treatment of jaundice and rheumatism.
7. The stem extract of the plant is a polysaccharide in the nature of, which has polyclonal B-cell mitogenic activity, and the active ingredient of the stem extract enhances the humoral response of mice.
8. Giloy juice (*Tinospora cordifolia*), which is a mixture of Giloy herb and Tulasi leaves, is used to fight malaria in monkeys.
9. Aqueous extracts of Giloy stems showed anti-inflammatory effects in models of acute and subacute inflammation.
10. TC shows anti-allergic rhinitis activity. Allergic rhinitis is an atopic disease, a hypersensitivity reaction to exposure to pollen from grasses, weeds, trees, dust, etc.
11. *cordifolia* stems show radioprotective activity.
12. It is used to treat jaundice as it lowers body temperature.

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